Germ-Granule Components Prevent Somatic Development in the C. elegans Germline.

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Public Summary:
Specialized ribonucleoprotein organelles collectively known as germ granules are found in the germline cytoplasm from worms to humans. In Drosophila, germ granules have been implicated in germline determination. C. elegans germ granules, known as P granules, do not appear to be required for primordial germ cell determination, but their components are still needed for fertility. One potential role for P granules is to maintain stem cell properties in the germline. This is suggested by the loss of P granules from germ cells that transform into somatic cell types. However, it has not been established whether loss of P granules is the cause or effect of cell-fate transformation. To test cause-effect, we severely compromised P granules by simultaneously knocking down factors that nucleate granule formation (PGL-1 and PGL-3) and promote their perinuclear localization (GLH-1 and GLH-4), and investigated if that causes germ cells to lose totipotency and initiate somatic reprogramming. We found that compromising P granules causes germ cells to express neuronal and muscle markers and send out neurite-like projections, suggesting that P granules maintain totipotency and germline identity by antagonizing somatic fate.

Scientific Abstract:
Specialized ribonucleoprotein organelles collectively known as germ granules are found in the germline cytoplasm from worms to humans [1]. In Drosophila, germ granules have been implicated in germline determination [2]. C. elegans germ granules, known as P granules, do not appear to be required for primordial germ cell (PGC) determination [3], but their components are still needed for fertility [4-6]. One potential role for P granules is to maintain germline fate and totipotency. This is suggested by the loss of P granules from germ cells that transform into somatic cell types, e.g., in germlines lacking MEX-3 and GLD-1 or upon neuronal induction by CHE-1 [7, 8]. However, it has not been established whether loss of P granules is the cause or effect of cell fate transformation. To test cause and effect, we severely compromised P granules by simultaneously knocking down factors that nucleate granule formation (PGL-1 and PGL-3) and promote their perinuclear localization (GLH-1 and GLH-4) [9] and investigated whether this causes germ cells to lose totipotency and initiate somatic reprogramming. We found that compromising P granules causes germ cells to express neuronal and muscle markers and send out neurite-like projections, suggesting that P granules maintain totipotency and germline identity by antagonizing somatic fate.